ZEISS Rollei-Mutars

Tele and Wide Angle Lens Systems for Rolleiflex Cameras

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To change the focal length of cameras with permanently built-in lenses, it is merely necessary to attach a telescope to the taking lens. A practical method is to use a Galilean-type telescope because it is of short and compact design. The Galilean-type telescope consists of a collective lens, followed at a considerable distance by a dispersing lens serving as an ocular. If used in the normal way, the attached telescope increases the focal length and produces a telescopic effect as shown in Fig. 1 (top, p. 46), whereas inverted use shortens the focal length and produces a wide-angle effect as shown in Fig. 1 on the bottom.

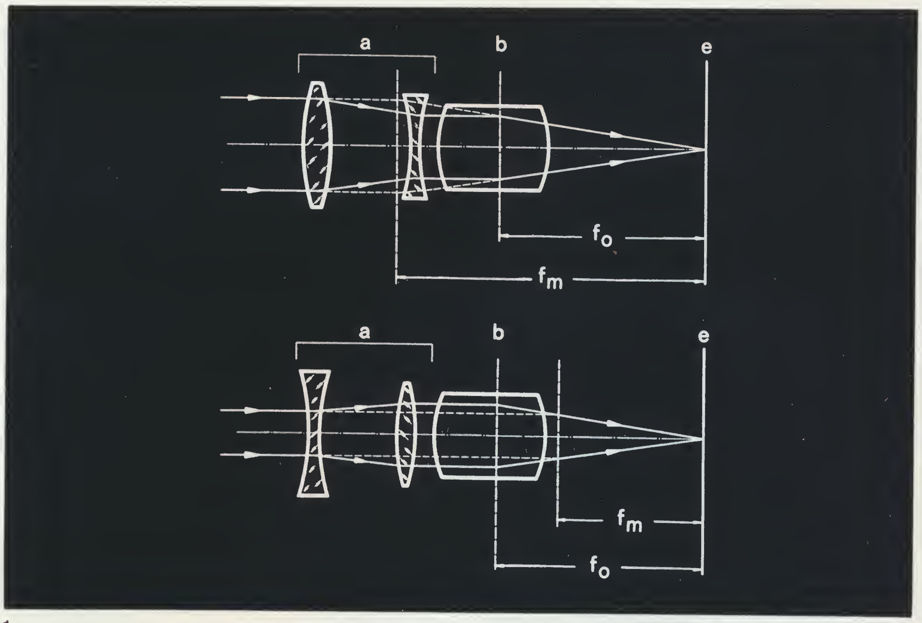
The common type of Galilean telescope, however, is suitable only for visual observation; it is effectively used in opera glasses of limited magnification as well as for a restricted field of view and, as such, has proven to be entirely satisfactory. The suitability of this type of telescope, however, for use as an attachment to a camera lens is extremely limited because of a considerable amount of image aberrations. Especially noticeable is the curvature of the image field which, in normal viewing, can be compensated for within certain limits by the human eye. In photography, however, as a consequence of such aberrations, only a small center area of the image field appears sharp. Furthermore, since commercially available Galilean-type telescopes have a relatively small field of view, extensive vignetting occurs which may ultimately lead to a complete cutting off of the corners of a picture.

Figs. 2, 3, and 4 demonstrate these effects. The first picture (Fig. 2) was taken with a 2¼ x 2¼ inch camera with an f/3.5, 75 mm. lens. Pictures 3 and 4 (p. 48) were taken with a simple Galilean telescope, attached to the taking lens first in normal and then in reversed position, with the taking lens stop set at f/8. The pictures 3 and 4 thus show not only considerable vignetting, but also a progressive decrease of sharpness towards the corners. Continued improvements in the development of telescopes for use as tele- and wide-angle attachments for 8 and 16 mm. movie cameras resulted in the elimination of these deficiencies and made it possible to obtain good image quality over the entire field.

That this development was primarily applied with success to 8 and 16 mm. movie cameras only, is explained by the fact that the angle of view of the taking lens of movie cameras is relatively small and is usually not more than 30°. Furthermore, the diameter of such lens systems in comparison to the image field can be relatively large. The standard lens in still cameras has a much larger angle of view and the diameter of the front element of the lens system is governed by this larger angle of view. In 2¼ x 2¼ inch cameras with an image diagonal of nearly 80 mm., focal lengths of the standard lens are 75 or 80 mm. with angles of view of 56° or 52°, respectively, measured over the image diagonal. Therefore a telescope used for changing the focal length in front of such a taking lens would have to accommodate an angle of view of 56° or 52°, respectively. However, there can be no doubt that the immensely greater difficulties encountered in the correction of image errors for such large angles of view at relatively small front lens diameters have been responsible in the past for marketing of lens attachments for 2¼ x 2¼ in. cameras which resulted in good pictures only at small stops, and even then they failed to fully cover the corners*.

Hence, the only solution for changing the focal lengths in 2¼ x 2¼ in. cameras was the interchanging of the whole standard lens against a lens of shorter or longer focal length. This method can be applied to twin-lens reflex cameras only at the expense of considerable disadvantages. These arise not only from the need of changing both taking and viewfinder lenses, but from the considerable mechanical difficulties encountered

* In this connection, the use of commercial type prism binoculars to change the focal length on 2¼ x 2¼ inch cameras can be disregarded. Such combinations merely result in obtaining focal lengths of over 400 mm. with a small effective aperture, suitable for special photographic purposes only.



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in mounting lens and shutter assembly to modern cameras which today require the film transport and release mechanism to be coupled to the shutter, and the setting of the shutter speeds and diaphragm values to be coupled to the exposure meter. To do without these features in a modern twin-lens reflex camera would mean to lose the ease of operation and the distinguishing characteristics of this camera type. It is these features which to this day have made this camera design popular with large numbers of enthusiastic fans.

The new ROLLEI-MUTARS meet the demands for varying the focal length for the twin-lens reflex camera without interfering with the important characteristics of this type of camera. The extensive development undertaken over the past years in the ZEISS works in close collaboration with the ROLLEI works has been successfully completed.

The ROLLEI-MUTARS are high-quality lens systems that lengthen or shorten the focal length of the camera lens; they bear little resemblance to the Galilean-type telescope in their mechanical and optical design. Therefore, it may be appropriate to outline some of the ideas applied in the development of the Mutar lenses. No doubt, the most important characteristic in twin-lens reflex cameras is the fact that the viewfinder image can always be seen, even when the shutter is released. In order not to forego this important feature, the possibility of developing a system that changes the focal length, which is used first in front of the viewfinder lens and then switched to the taking lens, had to be discarded. There-

Fig. 1 (top): Shows schematically the effect of a Galilean-type telescope (a) in front of a taking lens (b), in normal position to increase the focal length from the value f_o to the value f_m.

Fig. 1 (bottom): Shows schematically the effect of a Galilean-type telescope (a) in front of the taking lens (b), in reversed position to shorten the focal length from the value f_o to the value f_m.

The film plane is in both cases marked "e".

Fig. 2: Shows a picture taken with an f/3.5, 75 mm. lens with a 2¼ x 2¼ in. camera for comparison with figures 3 and 4.

fore, it was necessary to design a twin-optical system, effective in lengthening or shortening the focal length of both the taking and the viewfinder lens.

As known to experts, it is advantageous in the correction of such systems that the individual refractive power of collecting and dispersing components be kept to a minimum or, on the other hand, that their individual focal lengths be as long as possible. The fulfilment of these requirements results in relatively large dimensions. Since the diameters of the optical elements for changing the focal length, contained in the Mutar systems are dependent upon the distance between the optical axes of the viewfinder and the taking lenses, it appeared appropriate to allot more space to the optical system of the taking lens than to that of the viewfinder lens. In the latter, it is sufficient to merely meet requirements relative to illumination and resolution which are satisfactory for the viewing and focusing of an object. However, the optical system for changing the focal length of the taking lens calls for much higher corrections. The image field must be evenly illuminated right into the corners and must be covered with best definition to meet quality requirements far in excess of those for the finder lens. From these considerations arose the necessity to develop systems to change the focal length of taking and viewfinder lens which differed greatly also in their optical construction. Concerning the mechanical construction there was also a new design necessary. To utilize as far as possible the space available between the optical axes of both viewfinder and taking lens, in order to accommodate optical parts, a single housing was devised for their installation. This offered at the same time the advantage of interchanging the Mutar twin-lens system as easily and rapidly as a filter on a lens bayonet. There is no interference whatsoever with the mechanism of the camera and the taking and viewfinder lenses.

The optical design of the ROLLEI-MUTARS is shown in Figs. 5 and 6. Fig. 5 shows a cross-section of the twin system for increased focal length and Fig. 6 depicts a cross-section for shortened focal length. The dotted lines on the right in the illustration indicate the front elements of the taking and viewfinder lenses in front of which the four or five elements of the Mutar system are located. As engraved on the mount of the lens, the Tele-Mutar shown in Fig. 5 increases the focal length 1.5 x, i. e., in lieu of a focal length of the taking lens of 75 or 80 mm., the combined focal length amounts to 110 or 116 mm., respectively. The WIDE-ANGLE MUTAR, a cross-section of which is shown in Fig. 6, changes the focal length of the taking lens 0.7 x. This results in a combined focal length of 54 or 57 mm., respectively, instead of 75 or 80 mm. Figs. 7 and 8 show pictures taken with ROLLEI-MUTAR lenses which, for reasons of comparison, have been taken from the same location.

Owners of twin-lens reflex cameras, however, are not only interested in the increase or decrease of the focal length of the taking lens of the new ROLLEI-MUTARS, but also in the image quality which determines the suitability of their negatives for enlargement. It is important to know that these new lens systems no longer require smallest lens stops in order to obtain good definition and thereby negatives which can be greatly enlarged. As proven in the field, the ROLLEI-MUTARS produce a remarkably good image quality even at the largest aperture of f/4. Comparative pictures taken with the TELE and WIDE-ANGLE ROLLEI revealed that ROLLEI-MUTARS have to be set only at about one lens stop higher than the tele and wide-angle lenses used in these special cameras in order to achieve the same image quality. This fact more than any other proves the outstanding performance of ROLLEI-MUTARS.

An examination of the cross-sections of the ROLLEI-MUTARS also gives the answer to the question why one and the same system could not be used interchangeably, i. e., once in the normal way for increasing the focal length and reversed for shortening the focal length. In order to obtain good picture quality right into the corners, it was necessary to design the tele-system fundamentally different from the wide-angle system. Although ROLLEI-MUTARS bear little resemblance to the Galilean-type telescope, which was the original point of departure in their development, one of their characteristics reveals that they are afocal telescopic systems set at infinity; if the ROLLEI-MUTARS are attached to taking and viewfinder lenses, both set at infinity, correct focus is retained in both. Also with the ROLLEI-MUTAR systems attached, short-distance focusing is done in the usual manner by turning the focusing knob on the camera. Viewing and selecting the proper composition are also done as usual on the viewfinder screen. Should one decide to measure or estimate the distance instead of focusing on the ground-glass screen, one should keep in mind that the distance scale on the focusing knob of the camera no longer applies to the lens attachments. With a ROLLEI-MUTAR attached, the object distance is changed by a factor which is approximately the square of the enlarging or reducing factor of the ROLLEI-MUTAR. To avoid complicated calculations, a computing scale is provided on top of each ROLLEI-MUTAR, which converts the distance setting of the ROLLEI-MUTAR to the corresponding setting on the focusing knob of the camera. Therefore, in the ROLLEIFLEX 3.5 F with the Tele-Mutar, the shortest focusing distance is 1.65 m. (5 1/2 ft.), and with the WIDE-ANGLE MUTAR, the closest focusing distance is 0.51 m. (20 in.). For ROLLEIFLEX 2.8 F, the closest focusing distances are 1.86 m. (6 ft.) and 0.57 m. (23 in.).

The housings of both Twin-MUTARS are so designed that a special filter in screw-mount may be attached in front of the lens. Furthermore, a rather ingenious feature is the design of the lens shade. A usual type lens shade would cut into the viewfinder field. Therefore, a collapsible lens shade was designed for the Twin-MUTARS which, in operating position, provides the desired effect without interfering with the field of view as seen through the viewfinder lens, while it can be folded back when the

camera is not in use, and thus serve as a protection for the front lens. When the lens shade is folded down, a part of the viewfinder lens is covered, indicating in the viewfinder that the lens shade is not in shooting position.

The mechanical and optical development of the two ROLLEI-MUTARS was adapted to the specifications of the ROLLEIFLEX 3.5 F and ROLLEIFLEX 2.8 F, i. e., cameras which have a distance of 45 mm. between viewfinder and taking lens axes and are equipped with lenses of a focal length of 75 or 80 mm., respectively. With the additionally available pairs of adapters, the attachment becomes also adaptable to ROLLEI cameras with an axial distance of 42 mm. between viewfinder and taking lens axes, e. g., the ROLLEIFLEX T with Tessar f/3.5, 75 mm. and the ROLLEICORD. The difference in the axial distance between the twin-attachments and the camera lenses results in a slight vignetting effect in the corners of the viewfinder image which does not interfere with viewing or focusing. Since the taking lens attachments, in each instance, remain in a coaxial position before the taking lens, the $2\,{}^1/_4$ x $2\,{}^1/_4$ in. format is fully covered right into the corners even in cameras with an axial distance of 42 mm.

The ROLLEI-MUTARS 1.5 x and 0.7 x considerably increase the range of application of ROLLEIFLEX cameras. The TELE-MUTAR enables the ROLLEIFLEX photographer to take a picture from the same shooting point, 1.5 x magnified. His use of the TELE-MUTAR, however, is not only limited to instances where the object cannot be approached as closely as may be desired. It also appears to be of equal significance that ROLLEIFLEX owners now have at their

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Fig. 3: Picture taken from the same location as that shown in Fig. 2 for which a simple Galilean telescope, consisting of a collecting and dispersing lens element was mounted in normal position.

Fig. 4: Picture taken from the same position as that shown in Fig. 2 with the same Galilean-type telescope mounted in reversed position.

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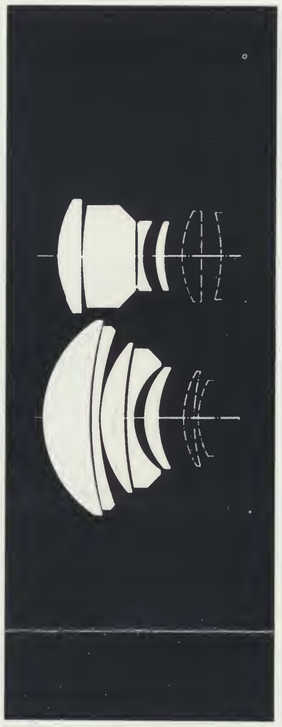

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disposal an additional means for picture composition. In many cases, such as portrait photography, more satisfactory perspective can be achieved with the TELE-MUTAR even though there may be no restriction as to the taking distance. The WIDE-ANGLE MUTAR 0.7 x converts the ROLLEIFLEX into a wide-angle camera. The use of the WIDE-ANGLE MUTAR is recommended where conditions either indoors or outdoors do not permit to take the whole subject without cutting off essential parts. WIDE-ANGLE MUTARS provide the necessary increase in the angle of view so essential for interiors, landscapes with wide horizons, architectural photographs, and news photography.

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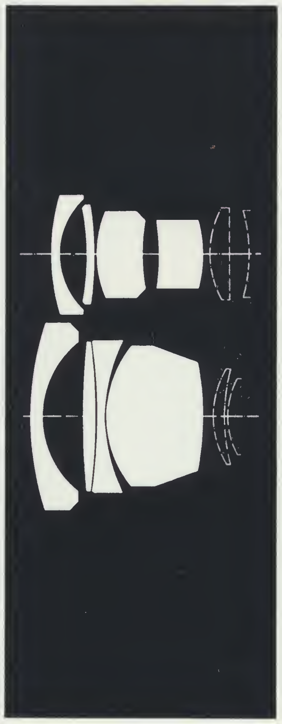

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Fig. 5: Cross-section of the ZEISS ROLLEI-MUTAR 1.5 x.

Fig. 6: Cross-section of the ZEISS ROLLEI-MUTAR 0.7 x.

Fig. 7: Picture taken with ZEISS ROLLEI-MUTAR 1.5 x from the same location as the picture shown in Fig. 8

Fig. 8: Picture taken with ZEISS ROLLEI-MUTAR 0.7 x from the same location as the picture shown in Fig. 7

Figs. 7 and 8: photographs by Erich Kramell.